

**Claims**

1. Apparatus for promoting bone growth, especially for osteosynthesis of bone fragments and/or fixation of bone fractures, which comprises at least one implant (10; 21; 25; 37; 43; 44; 49), at least one contact element (19; 24; 30; 35; 36; 47; 48; 55) coming into contact only with surrounding bone and the piezoelectric element and made from electrically conductive, especially metallic, material tolerable to humans and at least one piezoelectric element (18; 20; 29; 33; 34; 45; 46; 54) which is associated with the implant and which, under the action of forces, generates electrical pulses which serve as a stimulant for bone growth, wherein the at least one piezoelectric element is an integral component of the implant; the implant (10; ...) defines one pole, especially the negative pole, and the contact element defines the other pole, especially the positive pole, of the piezoelectric element (18; ...); and the piezoelectric element (33; 34) is arranged within the implant (10; ...) or within an implant pocket (31; 32) open towards the bone, especially in such a manner that it terminates substantially flush with the surface of the implant.
2. Apparatus according to claim 1, characterised in that the implant (10; 21; 43; 44) is in the form of a kind of dowel, in the central hollow space (17) of which is located the piezoelectric element (18; 20; 45; 46).
3. Apparatus according to claim 2, characterised in that the implant is a pin-like holder for an artificial tooth (11), a bone or pedicle screw (13; 43; 44), a bone fixation pin (21) or a bone fixation element (49).
4. Apparatus according to claim 1, characterised in that the implant is a hip-joint socket (25) having at least one opening (28) in its bottom, the piezoelectric element (29) being arranged to be located therein.

5. Apparatus according to claim 4,  
characterised in that  
the piezoelectric element (29) arranged in and filling the opening (28) in the bottom  
is integrally connected to a piezoelectric layer (29) extending over at least part of  
the inside of the bottom of the socket.
6. Apparatus according to one of claims 1 to 5,  
characterised in that  
the piezoelectric element is so constructed that, on normal loading of the bone  
structure, a current having an effective current intensity of about 10-100  $\mu\text{A}$  is  
arranged to be generated.
7. Apparatus according to one of claims 1 to 6,  
characterised in that  
the piezoelectric element is made from a piezoelectric ceramic, especially a  
zirconate or titanate ceramic.
8. Apparatus according to one of claims 1 to 7,  
characterised in that,  
when there are at least two piezoelectric elements, they are connected either  
electrically in series or electrically in parallel.